Enterprise Resilience of Maritime Container Ports to Pandemic and Other Emergent Conditions
(Technical Report)

Using ANT to Explore the Role of Regulatory Framework Acting as a Network Builder in Aviation Design Through the Case of the Boeing 737 MAX
(STS Research Paper)

An Undergraduate Thesis Portfolio

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Socio-technical Synthesis

Enterprise Risk and Resilience and the Role of Regulations in the Boeing 737 MAX Disaster

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The concept of risk resilience in large-scale systems is shared throughout both my technical work and STS research. Applying risk resilient engineering practices involves the systematic approach to identifying critical emergent conditions and applying algorithmic data analytics to calculate key safety-critical scenarios. Where the two works differ is which principles are prioritized during its implementation. My technical work explores the ranking of safety-critical scenarios in maritime ports, whereas my STS research seeks to identify whether decades-old, “tried-and-tested” safety regulations in the aviation industry hinder innovation in such a way that risk-resilience of aviation systems is reduced. Therefore, while my technical work and STS research differ in scope, they both utilize the same medium of risk-resilience to derive their conclusions.

My technical work focuses on using risk-resilient analytical methodologies to identify emergent conditions and calculate safety-critical scenarios that are disruptive to maritime ports. Our executive-level partners at the Port of Virginia entrusted us with performing a resilience analysis of their operations as well as their projected financial investments over the next 50 years. Our team then engaged in extensive research into emergent trends within the maritime container shipping industry and potential initiatives that would optimize operations at the Port. After multiple meetings with Port executives, our team built a multi-criteria analysis tool that quantitatively ranked each grouping of emergent conditions, scenarios, and initiatives. Finally, our team presented the results of this risk-resilience analysis to the CEO of the Port and were met with great applause. It is humbling to consider that our technical work has a direct effect on multi-billion-dollar investment decisions that directly impact the economic development of the State of Virginia and its employees.

Risk resilience is also used in my STS research, but in a different capacity. My research prioritizes understanding whether or not existing FAA regulations—thought of as “tried-and-tested”—discourage innovative design to such a point that overall industry-level safety is reduced via stagnation. In my research, I utilize ANT to explore the role FAA regulations have as a network builder for passenger aviation design. My claim is that when FAA regulators use risk-resilience methodologies to draft legislation, they should do so in a way that promotes dynamism in the long-run. Decades-old regulations contribute to airplane manufacturers like Boeing and Airbus only incrementally “improving” decades-old aircraft. An example of constrained innovation in new aviation design that supports my claim of stagnation reducing risk-resilience can be seen in the Boeing 737 Max, which I use as a case study throughout my research.

Synergizing the research applications of both my technical and STS work has added great value to my perspective as a systems engineer. My technical work has given me a solid quantitative foundation when analyzing risk resilient traits of a system, while my STS research has reminded me of the importance of avoiding stagnation even when “tried-and-tested” approaches are the dominant approach. I am confident that the knowledge I have accumulated throughout this course has made me a more ethical thinker and thereby a better engineer.